



National Aeronautics and Space  
Administration  
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# 2016 ESA/NASA ExoMars/Trace Gas Orbiter

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**MEPAG**

**June 16, 2011**

# Overview



- Joint ESA-NASA Mars Orbiter
  - Proposed launch in 2016
- Deliver ESA EDM
- 1 Mars year orbital science mission
- Telecom asset until 2022

# Contributions

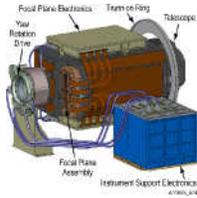
## NASA / JPL Proposed Mission Elements



**EMCS**



**MAGIE**



**MATMOS**



**Electra**



**Atlas-V – Baseline Class** **JPL-JG1**

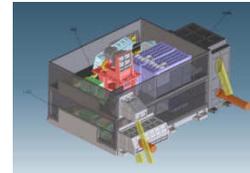


**JPL DSN**



**JPL SRA**

## ESA Mission Elements



**NOMAD Inst.**



**Entry / Descent Module (EDM)**



**Spacecraft / Orbiter**



**ESA ESTRACK**



**ESA ESOC**

2016 ExoMars/TGO

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**JPL-JG1**

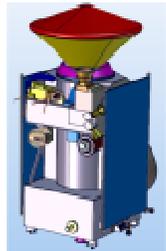
LV not selected yet  
Janis Graham, 5/18/2011

# EMTGO Mission Events (proposed)



## LAUNCH

Jan 2016



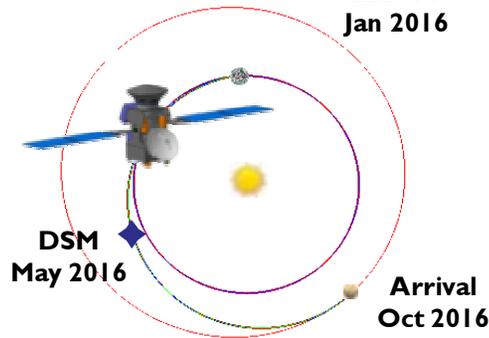
EMTGO in launch configuration



Atlas V 431

## INTERPLANETARY CRUISE

Launch Jan 2016



DSM  
May 2016

Arrival  
Oct 2016

Type II Trajectory:  $C3 = 7.44 \text{ km}^2/\text{s}^2$

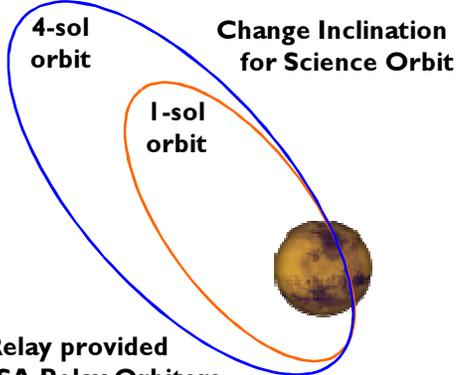
## APPROACH, EDM RELEASE & MOI



MOI & EDL Comm

- EDM release at MOI - 3 days
- Orbiter retargets to MOI altitude
- MOI captures to 4 sol orbit

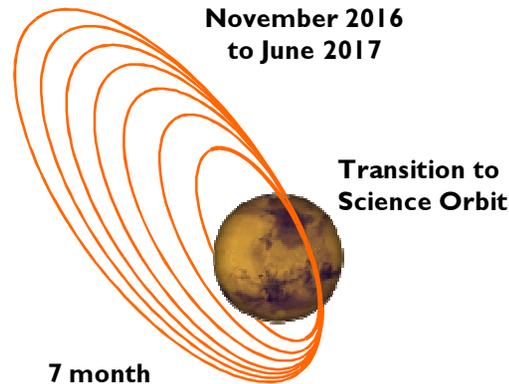
## EDM RELAY & TRANSITION TO I-SOL ORBIT



EDM Relay provided by NASA Relay Orbiters

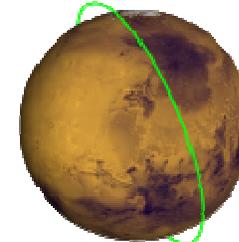
## AEROBRAKING PHASE

November 2016 to June 2017



7 month Aerobraking

## SCIENCE & DATA RELAY PHASE



- Science & Relay Orbit
- 400 km Frozen
  - Rotates every 4 months
  - Phased for 2018 Relay

- Science Phase: 1 Mars Year 6-2017 to 6-2019
- Relay Phase: 2018 Rovers Jan 2019
- Relay Phase: Future Missions through 2022

2016 ExoMars/TGO

# Prioritized Science Objectives



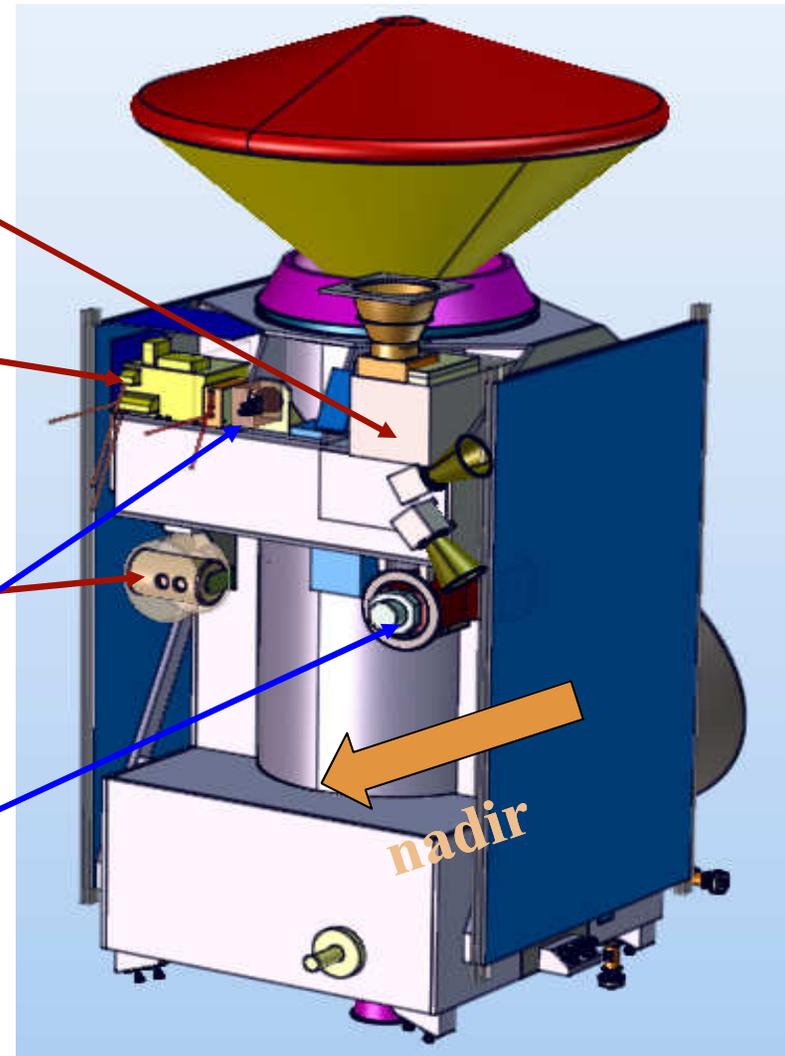
- Detect a broad suite of atmospheric trace gases and key isotopologues.
- Characterize the spatial and temporal variation of methane and other species that could be signatures of active biological and/or geological processes (for example,  $C_2H_6$ ,  $SO_2$ ,  $N_2O$ ) and of photochemical species that determine atmospheric lifetimes (e.g., representative  $O_x$ ,  $HO_x$ ,  $NO_x$  species) and their source molecules (e.g.,  $H_2O$ ).
- Localize the sources and derive the evolution of methane and other key species and their possible interactions, including interactions with atmospheric aerosols and how they are affected by the atmospheric state (temperature and distribution of major source gases; e.g.  $H_2O$ ).
- Image surface features possibly related to trace gas sources and sinks.

# Proposed Payload



2016 ExoMars/TGO

<p><b>MATMOS</b> Solar occultation Fourier transform IR spectrometer <i>(w/ Canadian contribution)</i></p>
<p><b>NOMAD</b> Occultation + mapping IR, Vis, UV spectrometer <i>(consortium of Belgium, Spain, Italy, UK)</i></p>
<p><b>EMCS</b> Thermal IR spectrometer</p>
<p><b>MAGIE</b> Wide-angle Vis-UV camera</p>
<p><b>HiSCI</b> High resolution, colour, stereo camera <i>(w/ Swiss contribution)</i></p>



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**JPL-JG3**

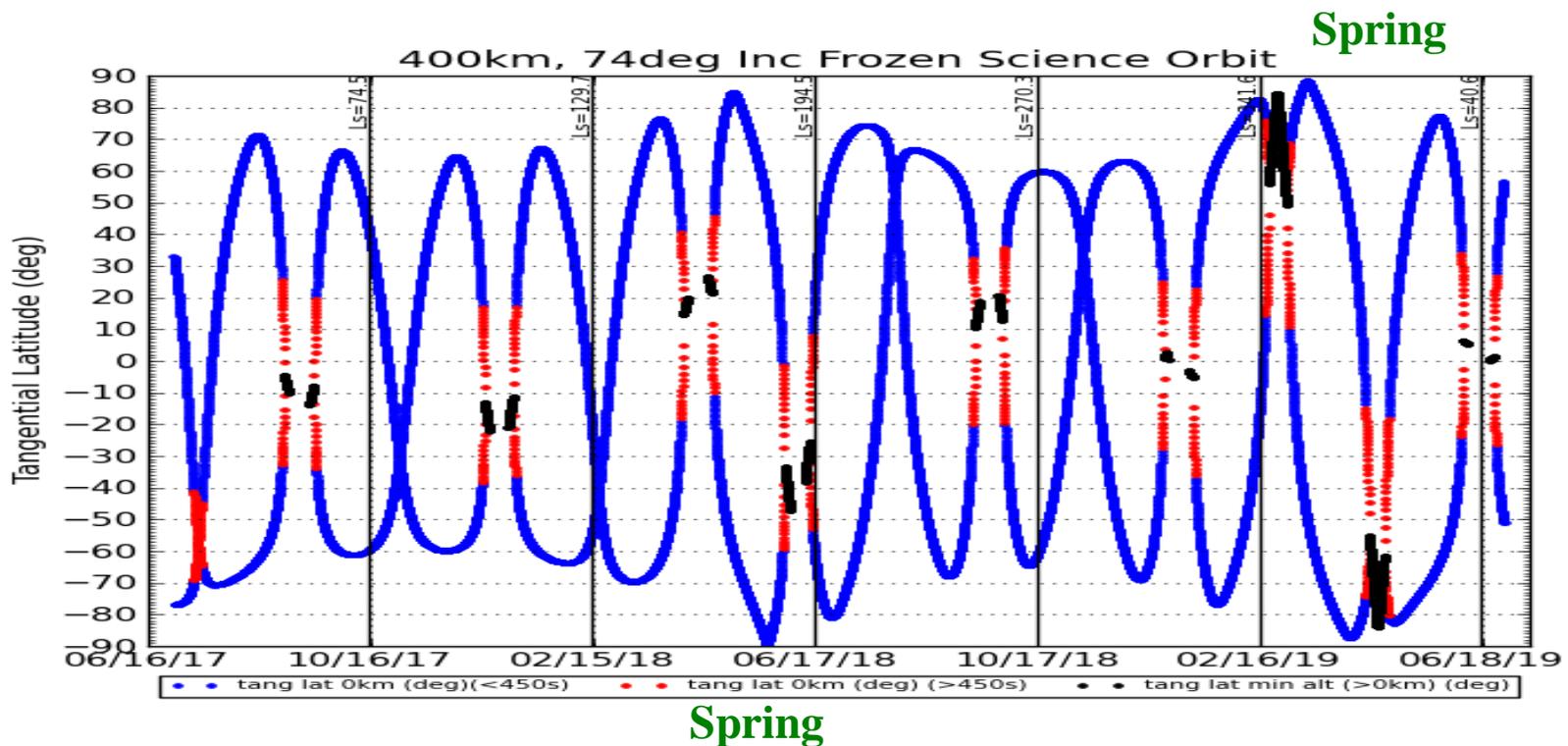
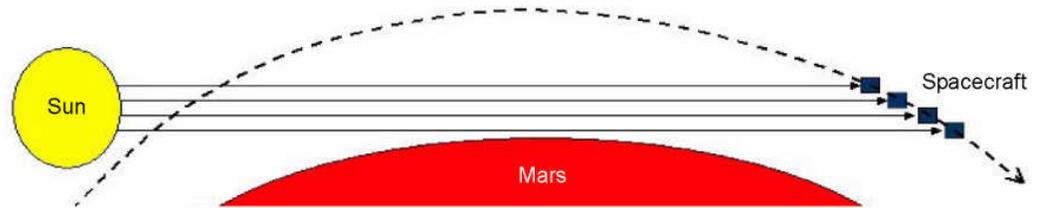
**Is this all of the instruments?**

Janis Graham, 5/18/2011

# Solar occultation

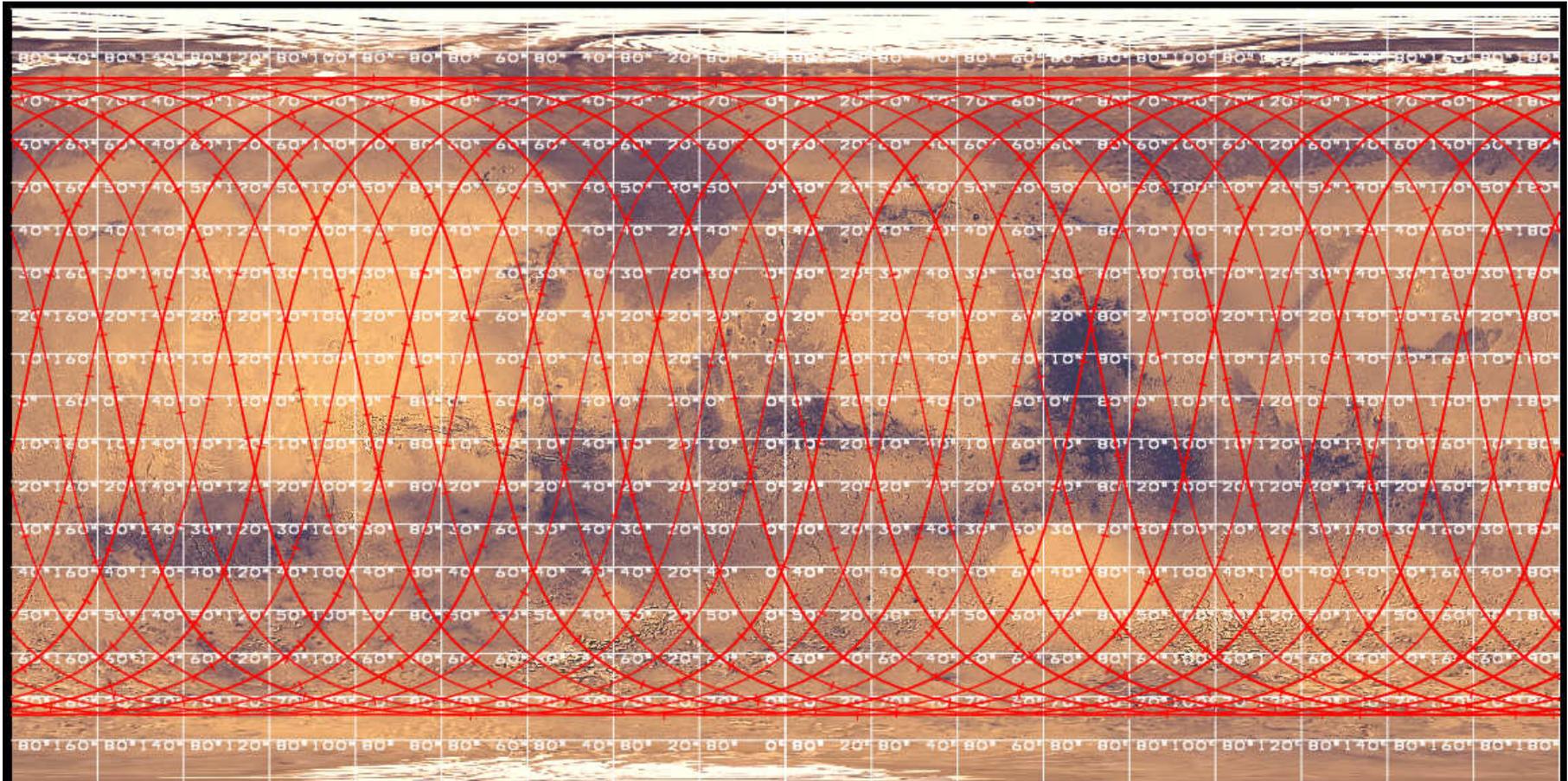


- Ultrahigh sensitivity
  - Bright light source
  - Long pathlength
- Orbit inclination: 74°



# Nadir mapping

- Ground track for 3 days



2016 ExoMars/TGO